

### Abstract

A method and apparatus for increasing in the data rate of a multiple-input and/or multiple-output system that has frequency selective fading by using training sequences with both low normalized auto-correlation and low normalized cross-correlation. Both 1) the sum of the square of the normalized auto-correlation of each training sequence over an auto-correlation window and 2) the sum of the square of the normalized cross-correlation of each pair of the training sequences over a cross-correlation window, are significantly less than unity. In one embodiment of the invention the training sequences are shifted versions of each other, and the low normalized cyclic-auto-correlation of cyclic sequences is significantly less than unity, with each cyclic sequence being  $N'$ ,  $N'=N-L+1$ , symbols of one of the at least two training sequences. In another embodiment, the training sequences are ones where the trace of the inverse of the product of the matrix of training sequences' symbols and the conjugate transpose of this matrix is low. The matrix is a function of the number of symbols over which multipaths of significant power can arrive, the number of training sequences, and the number of symbols in a training sequence. More particularly the matrix is a block-toeplitz matrix composed of the training symbols.